

Sustainability of Groundwater Resources project

Progress Report and Meeting Summary of advisory team meeting Oct. 24, 2002

October 30, 2002 – Compiled by Ted Diers, NH Coastal Program

Funding --

Community funds – To date, 18 communities have pledged financial support for the project and 12 have made payments to OSP. The total funds collected are about \$45,000. Grants from the Office of State Planning have been made to NHGS and USGS. The NHGS funding has been delayed by various bureaucratic issues but a new employee should be on board by January. The funding for USGS has now expired and additional funding is necessary before more work can continue on the project. As a result, the project is off to a slower start than originally intended. The bulk of the funding for the project is anticipated from a federal appropriation. However, the entire federal budgetary process is expected to remain in limbo until December at the earliest. If all goes well, the money for the rest of the project should be available sometime in June 2003. The New Hampshire Coastal Program will attempt to make funds available to USGS as quickly as possible.

Compilation of existing data – These activities are being carried out by the NH Geological Survey.

A. Monitoring Well Network Expansion

- Searched for 61 Stratified Drift Aquifer (SDA) wells constructed from 1984-1987. Of these, 17 SDA wells successfully found. This excludes DDW-46 which is currently being monitored. Each of the 61 wells has an inspection report with details about the wells, or, for those wells not found, information on the believed location, or possible reason for destruction (new construction in area, etc.).
- SDA wells range in condition from those capable of being rehabilitated and used for future monitoring to those in such poor condition that proper decommissioning is recommended. Those that can be reconditioned are located primarily in the center and in the North of the Piscataqua River basin. A digital photo and GPS coordinates were obtained for every well located. Water levels were measured where possible.

B. Data Mining

- MS Access database currently being designed to serve as a repository for water level data from the SDA wells and data from reports associated with contaminated sites [i.e., Leaking Underground Storage Tank (LUST), and Underground Injection Control (UIC) sites] on file with the DES Waste Management Division. These sites tend to have numerous monitoring wells installed for water quality sampling and generally include water level measurements. Sampling commonly occurs three times yearly and some sites have records that begin in the late 1980s.
- 181 files have been reviewed and notes recorded characterizing their general content. These notes include any ground water elevation measurements, any chemical testing for VOCs or inorganic compounds (for further possible studies, especially any involving inorganic compounds), site maps (noting any benchmarks), and indicate whether boring logs or well installation logs are present. An estimated 80% of the files yield data appropriate for the planned database.
- Information about the SDA wells and the contamination sites has been compiled in a GIS format, using ArcView, and will eventually include links to digital photos of the SDA wells.

C. Supplemental Well Inventory

- Availability of digital tax maps to support desktop inventory process has been assessed for all of Rockingham County and part of Strafford County

D. Surficial Geologic Mapping:

- Contracts to create seamless digital data layers for a 7-quadrangle area are being prepared for submittal to Governor and Council for approval

Streamgage monitoring network enhancements – This task belongs to USGS.

The USGS currently operates 5 existing streamflow gaging stations in the study area to provide basin-yield and flow characteristics information on some of the larger streams in the study area (table 1). These gages are “real-time” and can be accessed at: <http://nh.water.usgs.gov>. Five additional long-term streamflow gages are planned for the regional study to provide better geographic and physiographic coverage within the study area. FY03 network activities will focus on reviewing and selecting the new sites, obtaining access permissions, constructing the gages, and installing the required equipment. Once the gages are installed and operating, streamflow measurements will be made throughout the year, at various flow conditions, to develop a rating curve to calibrate stage height to streamflow. The current funding level will permit the installation of 3 of the 5 network gages in FY03.

The objective of the network enhancement is to obtain information that can be used to determine basin yields and hydrologic characteristics of larger relatively unregulated watersheds. Site selection emphasis will be placed on 1) larger, currently ungaged, watersheds, 2) developing watersheds, and 3) coastal drainages. Information that can be used in site selection to maximize benefits to existing or planned programs or activities is being evaluated by the project. Potential gage sites that are highly regulated or strongly influenced (dominated) by water management activities, such as downstream of a reservoir or major surface water withdrawal or return, will be avoided. Assuming that river reaches with stable channel cross-sections and suitable access can be found, preference will be given to those sites that maximize the upstream contributing drainage area. Final gage location is dependant on the suitability of an individual site for streamflow gaging.

The Winnicut gage is installed and collecting data. Progress towards developing a rating curve will continue. The potential gage site at the Taylor River is now considered a potential temporary site because it does not appear to be well suited to gaging.

Network enhancement sites, in approximate order of priority are:

- The Winnicut River in Greenland. This gage has been installed and will be operating throughout FY03. This site has a drainage area of 14.2 square miles and is centrally located in the immediate Seacoast area. Sustainability of water resources in this watershed have been an immediate concern for a number of years.
- The North River in Epping. This site has a drainage area of 50 mi² and it is the major tributary to Lamprey River (The Lamprey River is a designated river under the N.H. Rivers Management and Protection Program). The North River is relatively unregulated and the watershed is central to the regional study area in an area of considerable growth.
- The Isinglass River at the Rochester-Barrington town line. This is a newly designated river, under the N.H. Rivers Management and Protection Program, with a drainage area of 50 mi². Similar to the North River watershed this is a major, relatively unregulated (with the exception of Bow Lake releases) watershed central to the study area in an area of considerable growth. Understanding the streamflow characteristics of this watershed would be valuable to downstream communities.
- The Cocheco River at the Farmington-Rochester town line. The upper Cocheco River has a drainage area of at least 50 mi² and is central to the northern part of regional study. The upper Cocheco river is relatively unregulated and also in an area of considerable growth. Understanding the streamflow characteristics of this watershed would be valuable to the overall study and downstream communities.

- The Little River in Lee. This is a tributary to the Lamprey River with a drainage area of approximately 21 mi². This is a moderately sized watershed, central to the study area in an area with controversial growth and water use issues.
- The Piscassic River in Newmarket. This is a moderately sized coastal watershed (23 mi²), near the mouth of the Lamprey River.

Seacoast groundwater flow simulation – USGS

1. Evaluated preliminary model design, boundary conditions and data needs.
 - a. Assessed model boundary locations and boundary type (specifically southern and southwestern model boundaries). Model boundaries coincident with tidal water bodies (Squamscott/Great Bay, Piscataqua River, Atlantic Ocean) are obviously very well defined and conceptually straight forward to approximate. The southern and southwestern model boundaries are more difficult to approximate. Some large groundwater withdrawals are located near the hydrologic divides and political boundaries. To avoid complications at a southern model boundary it was necessary to extend the model grid to a significant hydrologic boundary. Significant hydrologic boundaries are provided by the tidal Merrimack River (a few miles south of the Seacoast area) and the Powwow River drainage to the southwest of the Seacoast.
 - b. Evaluated tidal boundaries and their effect on regional ground-water flow calculations. Consulted with Chris Langevin (USGS, Miami) who is a specialist on simulation of salt and fresh ground-water interactions. Discussed appropriated boundary location and equivalent fresh-water head calculations. Preliminary calculations indicate that Great Bay is effectively a barrier to ground-water flow from inland watersheds to the west.
 - c. Evaluated model discretization (grid cell size). Finer grid (200 ft² or less) provide good resolution of surface water features in the model, however this fine a discretization may not be needed for regional ground-water flow simulation. Locally ground-water heads show a high degree of variability, it would be more appropriate conceptually to assess a dataset with large variability using a larger discretization (such as 400 ft²). Additionally, using too fine a discretization provides a false assumption that ground-water flow calculations (specifically heads) can be accurately estimated at that scale.
 - d. Consulted with Mary Hill (NRP), other USGS researchers (Shapiro, Hsieh), and the USGS Office of Ground Water (OGW, Barlow, Reilly, Winston) on data analysis, head observations, and unique uses of existing information (such as using pond/wetland elevations as a regional calibration data set).
 - e. Preliminary analyses indicate the need for ground-water flux (stress) information. Fluxes includes stresses such as large ground-water withdrawals. Without withdrawals very little flow will occur (or will be simulated) in bedrock aquifers. Information on current stresses are needed in order to calculate/simulate bedrock aquifer properties. Given current withdrawals, and ground-water levels and streamflows, the flow model can be used to estimate the hydraulic characteristics of bedrock aquifers. Specific information needed include total annual streamflow totals from watersheds in Seacoast and bedrock aquifer withdrawals (water use). Given basin yields, from stream gage information, and water use information, preliminary model analyses indicate that a model parameters can be estimated with high degree of confidence (within an order of magnitude) for critical model parameters such as hydraulic conductivity. Preliminary analyses are being synthesized to further illustrate and prioritize data needs.
 - f. Discussed some data needs with NHGS, including locating USGS installed observation wells and data mining. Discussed ground-water data inventory forms. Further coordination with NHGS on data compilation is planned.
2. With limited funding in Federal fiscal year 2003 (FY03), this years Seacoast Model activities and data collection efforts will be focused on streamflow gaging. This information cannot be obtained from any other source and streamflow gaging information is crucial to understanding a regions water

balance. Data mining efforts may yield considerable information on water levels, including water level trends, and surficial and bedrock aquifer properties. Emphasis will be placed on coordination and collaboration with NHGS data mining effort to obtain and compile information.

3. The Seacoast Model effort requires installation of temporary stream gages. With the current funding levels it is anticipated that 3 to 4 gages can be installed in FY03. Activities will consist of reviewing and selecting the new sites, obtaining access permissions, constructing gages, and installing the required equipment. Once the gage is installed and operating, streamflow measurements will be made throughout the year, at various flow conditions, to develop a rating curve to calibrate stage height to streamflow. Gages will be located to provide streamflow information at the larger watersheds in the model area while also providing more complete coverage of the different geologic conditions present. The watersheds assessed in this analysis will include those affected by water uses, and water use management activities, such as large ground-water withdrawals, impervious surfaces, sewerage, and water returns. The project is working with local communities to identify gage sites that have potential for being upgraded to long-term gages with additional (town) funding. Assuming that river reaches with stable channel cross-sections and suitable access can be found, preference will be given to those sites that maximize the upstream contributing drainage area while remaining free of tidal influences. Final gage location is dependant on the suitability of an individual site for streamflow gaging. The number of gages installed in FY03 is also dependant on the cost of each gage installation and the logistics involved with individual sites. Seven temporary gage sites have been reviewed by surface water staff. Four sites are ready to be set up, 3 need further analysis. Taylor River was originally planned as a potential full gage, however no suitable gage location was identified.

Temporary streamflow gage sites being considered are:

- a. Little River, North Hampton, 6.2 mi²
- b. Berry's Brook, Portsmouth, 6.2 mi²
- c. Hampton Falls, Hampton Falls/Seabrook, 6.7 mi²
- d. Bailey's Brook, Rye, 2 mi²
- e. Mill Brook, Stratham, 2.5 mi²
- f. Great Brook Kensington, 10.7 mi²
- g. Taylor River, Hampton, 8.4 mi²

Regional water use investigation – USGS

A. Collect and Compile Data

- Quantify use by major users – obtained list of all user, names, addresses, number of employees, and Duns Number for all businesses with more than 5 employees from Dun and Bradstreet.
- Characterize Community System – Obtained GIS coverage of all community-water and wastewater systems from DES.
- Domestic per capita use – Investigated meter availability for domestic households; requested Census data to provide ancillary data for metered and un-metered use.

B. Data Management

- Update NEWUDS – All active (2000) registered water users and all community water suppliers entered into NEWUDS. Annual 2000 withdrawal and return data entered for registered users.

Regional Groundwater Availability Estimation – NHGS

- Some preliminary research into potential analytical methods has been performed. Proposed strategy is to employ multiple methods to derive a range of estimates for each hydrologic unit in the study area. These are likely to include water balance models, recharge estimation based on regression tool being developed by USGS, and site-specific analysis of well hydrographs. Committee guidance will be sought to select and refine the final methodology.

Comments and suggestions by Groundwater Project Advisory Team members:

The project proponents should show up at a selectmen meeting in the communities which have pledged dollars to show appreciation for the pledge. Also, towns that are being approached for funding in the next town meeting should also have a presentation.

There is some confusion in the NH Legislature between this project and the Instream Flow Project. We need to figure out some way to clear up this confusion to make way for funding of the Instream Flow Project.

Rick Chormann announced that DOT will help to survey in wells to add to the monitoring well database. This is much needed assistance and will allow DES to spend some project funds on other items in the work plan.

Town volunteers may be asked to help verify the state's private well data.

Stratham has a new questionnaire about well going out to its residents. The questionnaire will be made available to other communities through the RPC.

The Bellamy River is the only major coastal tributary without a water level gage, and several people have suggested adding the Bellamy as a site for a permanent stream gage. Tom Mack reported that they are hesitant to put one there due to the reservoir, withdrawals and water treatment plants. Tom Ballestero suggested that additional criteria be added in choosing gage sites such as sewer issues, aquifer recharge potential, and other future water supply issues. Another gaging location mentioned was on the Little River in Epping. It was suggested to raise this as a potential cost share with USA Springs. Rick Chormann reported that he is coordinating with others in state government such as NPDES and Fish and Game to see if they have gaging needs. Danna Truslow suggested speaking with the Dearborn Creek watershed group about their interest in supporting a site.

Matt Davis reiterated his concern about the lack of direct goals and objectives in the modeling effort. He is concerned that another technical meeting might be necessary to discuss the output of the model.

Rick Chormann suggested the USGS look at a recent American Water Resources Foundation report that used data loggers to look at water use. These data loggers may still be available to borrow.

Several people mentioned that there is a team of people taking a look at soils with an eye towards recharge and septic system issues. Steve Hundley of NRCS would be contact and their work may have some utility in the modeling of what happens when communities move from septic to sewers.

USGS and OSP are looking at publishing a fact sheet on NEWUDS as an interim product of the overall study.